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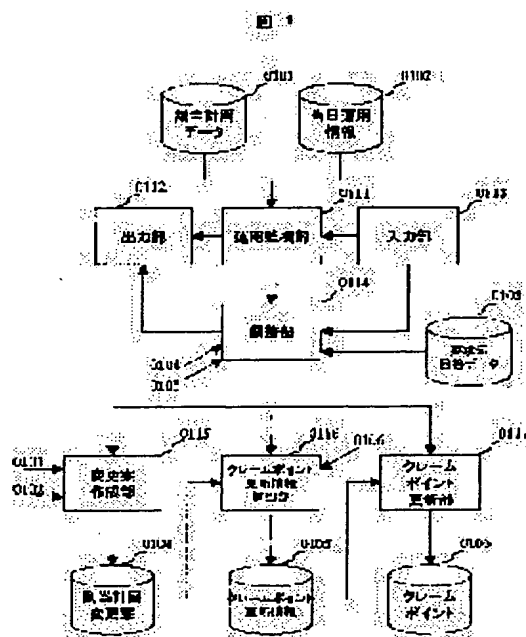
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## (54) RESOURCE ALLOCATION MANAGEMENT SYSTEM

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a resource allocation management system allowing a person in charge to be able to change an allocation plan and to perform the adjustment among persons concerned efficiently with a small load, in a resource allocation management for monitoring and controlling the use thereof by allocating finite resources to a plurality of jobs.

**SOLUTION:** When a resource allocation plan is changed by giving a point 0106 to a job requester, based on allocation plan data 0101 and an operation information on the day 0102, a plurality of allocation plan change plans are prepared 0115 and, based on the allocation plan change plans, point updating information 0105 showing the point variation of the job requester before and after the change plans are executed is calculated 0116. A coordination part 0114 selects an optimum allocation plan change plan based on the point updating information, notifies the job requester of the optimum allocation plan change plan and the point updating information and, based on the reply 0103 of approval or disapproval to the notification from the job requester, performs again the selection and notification of the change plan or determines the change plan to update the point based on a request history from the job requester up to the definition of the point updating information and change plan for the change plan.



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CLAIMS

[Claim(s)]

[Claim 1] Are the resource allocation managerial system which changes allocation of the resource used in order to perform said job to two or more jobs of each which are the processing which should be performed, and said each of two or more jobs are received. As opposed to the means which assigns a resource, and said each of two or more jobs A means to match and memorize the number of jobs of the predetermined number according to said assigned resource, A means to receive the change request to assignment of said resource, a means to acquire the resource status information which shows the activation situation of each assigned resource, and by changing said number of jobs based on said resource status information The resource allocation managerial system characterized by having a means to perform modification to said change request.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to \*\* which distributes the resource for performing predetermined processing using a computer. In fields, such as traffic, production, PD, etc., such as spot management [ in / in the inside of it / an airport ], seat reservation of a train, staffing of a production site, and allocation of a delivery car The resource of finite is distributed to two or more jobs, and it is related with the computing system for specifically canceling contention of a resource about the technique and equipment which support the business (resource allocation management business) which supervises and controls the use by the calculating machine, adjusting the interest of job demand origin.

[0002]

[Description of the Prior Art] Hereafter, the spot management business in the airport in the aeronautical-navigation field is taken up as an example of resource allocation management business, and the conventional technique is explained.

[0003] A spot is the parking tooth space of the aircraft in an airport apron. Usually, the aircraft is parked at an apron to either of two or more spots, and carries out start dead works, such as getting on and off of a passenger, conveyance of a load, and oil supply, cleaning, check, there after arriving at an airport until it leaves again. The parking demand (spot demand) of the aircraft is received in advance from two or more airlines, and spot management business is roughly divided into the business (spot employment monitor business) which supervises the business (spot allotment plan creation business) which draws up the allotment plan of a spot, operation of (1) (2) aircraft, and a spot use situation. Here, a "resource" and an airline correspond to "the requiring agency" of a job, respectively. [ need / the "job" of parking of the aircraft and a spot / for job execution / a spot demand ]

[0004] In addition to these, computing the spot dues (parking tariff) of each airline based on a spot use track record depending on an airport is also included in a part of spot management business. Moreover, as for spot management, it is common that it is under jurisdiction of an airport commissioned company (public corporation), and the business is performed by the personnel of a commissioned company (public corporation).

[0005] The method which acquires the modification data and track record data of arrival of the aircraft and a start on real time through a communication line, updates spot allocation information based on it about the monitor method of the allocation situation of a spot of having used the computer, and is automatically outputted to graphical representation equipment is well-known (JP.5-151226A). However, this does not automate formulation of a modification plan when trouble arises including adjustment with an airline to implementation of a plan, either.

[0006] For turbulence of operation by weather aggravation, the delay of the various activities under parking, etc., other aircrafts of a use schedule of the same spot and interference, i.e., contention of a resource, were produced, and when it became clear that a spot cannot be used as planned, as it was the following, the plan was changed conventionally.

- (1) Create a modification proposal manually based on experience, a person in charge taking various conditions into consideration.

(2) Use FAX, a telephone, etc. for the airline which becomes a candidate for modification, connect the contents of modification to it, and aim at deliberations and adjustment. Depending on the case, correction is manually added to a modification proposal in response to the claim from an airline.

(3) While approving a modification proposal as a formal spot allotment plan after adjustment and notifying to one's related posts, such as an airline and oil supply service, perform subsequent employment monitors based on this.

[0007]

[Problem(s) to be Solved by the Invention] Although planned modification at the time of the employment monitor of spot management business generally follows the above-mentioned flow, it is rare that a modification proposal is approved by whenever [ - ] in the case of the inquiry to an airline, a claim comes out from an airline to the contents of modification, and adjustment often runs into difficulties in many cases. This had become a person's in charge big burden in the conventional spot management business.

[0008] Sudden spot modification of employment that day is not desirable for every airline in order to cause planned modification of a staff and equipments in connection with various activities, such as oil supply and cleaning. For example, naturally the situation that the \*\*\* schedule of the oil supply car which moves in the inside of the vast apron of an airport is out of order, and re-communication for correction and worker of a schedule is needed with spot modification is considered that each airline wants to avoid if possible. Such various demerits that spot modification causes are the fundamental factors accompanying adjustment of a modification proposal in difficulty.

[0009] In addition to this, that it cannot adjust smoothly has a problem also in the technical side face in the conventional spot management.

(1) There is no clear policy of planned modification. That is, the person in charge is performing creation of the conventional modification proposal manually, and a much clatrap element is strong. Therefore, creation of the rational modification proposal in alignment with a clear policy an airline is satisfactory was difficult.

(2) There is no consideration of fairness in planned modification. For example, suppose that the situation of choosing A company or B company as the object of spot modification in the case of modification proposal creation arose. In A company, delay of operation turbulence and an activity causes [ many ] planned modification in many cases. On the other hand, B company does to operation and an activity being exact and almost not becoming the cause of planned modification. In this case, although it could be said to be decision with fair choosing A company as an object of spot modification when other conditions were completely the same, such consideration always was not expectable by clatrap handicraft like (1). Moreover, since it also set like the adjustment fault and the consciousness of fairness was lacked, only the claims of a specific airline are accepted as a result and the situation that other airlines received disadvantageous profit might happen.

(3) There is no suitable communication means between persons in charge. Since a limitation was in the capacity to tell correctly an intention of the contents of modification and a person in charge, only by the telephone or FAX, it was inconvenient to perform complicated adjustment efficiently.

[0010] As mentioned above, although the trouble was explained by making spot management business of the aeronautical-navigation field into an example These are not what specialized only in spot management business, and set seat reservation of a train, staffing of a production site, allocation of a delivery car, etc. in fields, such as traffic, production, and PD, the business which distributes the resource of finite to two or more jobs, and supervises the use -- in case it is, and contention of a resource is canceled, adjusting the interest of job demand origin, it is the problem which is widely common.

[0011] The purpose of this invention solves the above-mentioned trouble in connection with resource allocation management, and is to offer the resource allocation managerial system using a computer with a person in charge able to perform modification of an allotment plan, and adjustment between the persons concerned efficiently by the small load.

[0012]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention gives the point to job demand origin. In case a resource allotment plan is changed, based on employment information, two or more allotment plan modification proposals are created on a resource allotment plan and the day. Compute the point update information of the job demand origin before and behind modification proposal operation, and the optimal allotment plan modification proposal is chosen based on point update information. The optimal allotment plan modification proposal and point update information are notified to job demand origin, based on reply of the acknowledgement from job demand origin, or not recognizing, selection and a notice of a modification proposal are performed again, or a modification proposal is decided, and the point is updated.

[0013] from the point current in the job demand origin which caused (1) planned modification in calculation of point update information -- subtracting -- (2) -- the job demand origin which came out other than this and had resource modification is added to the current point, is carried out and determines the point after planned modification.

[0014] In selection of a modification proposal, the point gap after planned modification chooses the smallest allotment plan modification proposal preferentially using the point update information over a modification proposal.

[0015] from the point current in the job demand origin which caused (1) planned modification in renewal of the point according to point update information -- subtracting -- (2) -- the job demand origin which came out other than this and had resource modification is added to the current point. Furthermore, to the job demand origin which has answered un-recognizing by modification proposal decision, it subtracts from the present point and the point is updated. Moreover, a modification proposal with few amounts of modification from a current plan creates preferentially.

[0016] Moreover, it has the record means of an image and voice, and direct negotiation with the person in charge of the job demand origin using an image and speech information is enabled.

[0017] Moreover, it has a means to draw up the prior plan of resource allocation, and the point draws up the allotment plan which gave priority to job demand origin with much point over little job demand origin.

[0018] Moreover, it has a means to compute the toll of a resource, and according to the point of job demand origin, the point computes a resource toll by discounting the tariff of premium and job demand origin with much point for the tariff of little job demand origin.

[0019]

[Embodiment of the Invention] Below, the spot managerial system which is the gestalt of operation of this invention is stated to a detail using drawing 21. R> 1 from drawing 1 by making the spot management business of the airport in the aeronautical-navigation field applicable to application.

[0020] First, the gestalt of the 1st operation is explained using drawing 14 from drawing 1. [0021] The block diagram of the example of this invention is shown in drawing 1. In drawing 1, the employment Monitoring Department 0111 supervises whether based on the spot allotment plan data 0101, there are any abnormalities in the employment information 0102 on the day showing operation of the aircraft of a planned implementation daily allowance day, and a spot use situation. A controller 0114 is started, when the employment Monitoring Department detects abnormalities and the need for planned modification arises. A controller 0114 adjusts a modification proposal based on the requiring agency reply data 0103 obtained from the allotment plan modification proposal 0104 obtained through the modification proposal creation section 0115, the claim point update information 0105 acquired through the claim point update information calculation section 0116, and the terminal unit by the side of an airline (job demand origin). The renewal section 0117 of the claim point updates the claim point based on the claim point update information of the settled modification proposal. From the employment Monitoring Department 0111 and a controller 0114, the information about a monitor and adjustment is suitably told to a person in charge through the output section 0112. Conversely, from a person in charge, the control information about a monitor and adjustment tells to the employment

Monitoring Department 0111 and a controller 0114 through the input section 0113.

[0022] The configuration which realizes the gestalt of this operation to drawing 2 is shown. What is necessary is just to use what connected with the airline terminal unit 0205 and employment information offer equipment 0206 through the network device what connected an output unit 0203, storage 0202, and an input unit 0204 to the computer 0201, in order to realize the gestalt of this operation. In addition, a computer 0201 may be the object of output unit 0203 grade and one.

[0023] Stores 0202 may be not only magnetic storage but an optical disk, and semiconductor memory. What is necessary is just to have sufficient capacity, since program execution and data are stored in short.

[0024] \*\*\*\*\* [the number of them / a keyboard and other input devices may be used for it, and may be used for it combining them, or / any one] although the input device 0203 assumes the mouse. As for the input unit, 0203 should just have the function to receive information according to the actuation from a user. \*\*\*\*\* [the number of them / other output units may be used for it, and may be used for it combining them, or / any one] although the output unit 0204 assumes graphic display. That is, an output of the information which a computer 0201 has should be just possible.

[0025] Employment information offer equipment assumes that from which DTAX (domestic-air-traffic information processing relay system), FIS (flight information system) of each airline, etc. can acquire the operation situation and spot operating condition of the aircraft on the day.

[0026] Although the airline terminal unit 0205 assumes the computer for network clients equipped with input units, such as graphic display, a mouse, and a keyboard, at least, it may receive the modification proposal and point update information which are transmitted from a spot manager side, and may show them to the person in charge by the side of an airline, and other devices are sufficient as it as long as transmission of the response by the side of the airline to a modification proposal is possible. For example, the liquid crystal panel equipped with the switch for a response in which network connection is possible may be used. Even if it is the dedicated device manufactured in order to carry out this invention, the function of the above peripheral devices should just be satisfied.

[0027] With the gestalt of this operation, the allotment plan data 0101, the allotment plan modification proposal 0104, the claim point update information 0105, and the claim point 0106 are stored in the store 0202. Furthermore, the program performed in each processing section is stored in store 0202. Storage 0202 may be one storage physically, or may be two or more storage here. Moreover, employment information offer equipment 0206 and the requiring agency reply data 0103 are transmitted for the employment information 0102 through a network from the airline terminal unit 0205 on the day, respectively.

[0028] The DS of spot allotment plan data is shown in drawing 3. Each line of a table expresses the spot allocation to a spot demand and it, the item -- the order from the left -- "the serial number of a demand", "the airline of a requiring agency", an "inbound flight name", the "ETA" and an "outbound flight name", the "ETD", and an "allocation spot" -- it comes out. For example, the party eye of drawing means that Airline AA parks the aircraft of its company at an apron to spot \*\* from 10:30 to 11:55. Thus, allocation of a parking spot is performed in advance in allotment plan creation business to all the aircrafts using an airport, and it is collected as allotment plan data 0101.

[0029] The employment Monitoring Department 0111 supervises whether based on the allotment plan data 0101, there are any abnormalities in the employment information 0102 on the day transmitted through a network from employment information offer equipments, such as DTAX and FIS, and transmits the use situation of a spot to a person in charge serially through the output section 0112. The employment information 0102 includes spot beginning-of-using / termination information on (1) aircraft, the modification information on the operation schedule of (2) aircrafts, and the modification information on the work program under (3) parking at least on the day. Drawing 4 is a chart format which is an example of the transfer format of a spot use situation. The axis of abscissa of drawing expresses the time zone on the 1st, and an axis of ordinate expresses the spot in an airport. The part in which the part to which the mask 0402 was

given does not have a part [ finishing / operation ] and a mask expresses a part for the Planning Department. The white bar in a chart means a spot demand, for example, a bar 0401 can be read if the aircraft of Airline CC uses spot \*\* from 12:30 to 14:00. Moreover, left-hand side is [ an inbound flight name and the right-hand side of the notation drawn on the interior of each bar ] outbound flight names. The boundary parts of a mask part and a part without a mask mean current time, and move rightward with transition of time amount in the chart top.

[0030] The employment monitor business 0111 not only transmits a spot use situation to a person in charge, but performs the check of whether there is any trouble in future planned execution. As for drawing 5, operation of the aircraft shows an example of the situation which trouble produced to turbulence and planned execution in a chart format. Arrival delay occurs to the facilities of Airline AA for weather aggravation, and since the ETD of the outbound flight which uses the same equipments in connection with it is also overdue, the arrow head of drawing means being back postponed by the parking time amount of spot \*\*. Consequently, the way things stand, the spot demand and interference of BB company which are due to use the same spot will be produced.

[0031] Drawing 6 is an example of the planned modification proposal to the operation turbulence of drawing 5. The spot demand of CC company assigned to spot \*\* is moved to spot \*\*, and a spot demand of AA leading to modification is moved to spot \*\*. Thereby, generating of interference is avoidable. Moreover, drawing 7 is another example of the planned modification proposal to the operation turbulence of drawing 5. The spot demand of BB company assigned to spot \*\* is moved to spot \*\*, and a spot demand of AA leading to modification is moved to spot \*\*. Thereby, generating of interference is avoidable like the point. Thus, generally two or more planned modification proposals exist. In the above-mentioned example, although some modification proposals are considered besides two examples shown previously, they need migration of any spot demand nearby [ many ]. Two previous modification proposals are modification proposals with few jobs (spot demand) which change resource (spot) allocation so that clearly from drawing 5.

[0032] The event leading to planned modification is partly considered besides the turbulence of operation shown previously. Delay of the activity under parking that departure time interferes with delay and a consecutive spot demand by the carrying-in activity of a load being prolonged from a schedule is the typical example.

[0033] Although two or more modification proposals were generally considered as mentioned above, when abnormalities occurred, in the conventional spot management, the person in charge was creating the modification proposal manually based on experience in consideration of various conditions. On the other hand, in this invention, when the employment Monitoring Department 0111 detects abnormalities, while a controller 0114 is started and a controller 0114 creates a modification proposal automatically through the modification proposal creation section 0115, it communicates with the terminal unit by the side of an airline, and a modification proposal is adjusted semi-automatically.

[0034] Below, actuation of the controller 0114 in this example is explained using the processing flow of drawing 8. First, in step 0801, modification proposal creation processing is performed through the modification proposal creation section 0115 of drawing 1, and the allotment plan modification proposal 0104 of drawing 1 is obtained. The DS of an allotment plan modification proposal is the same as that of the allotment plan data 0101 of drawing 1.

[0035] The outline of this processing is explained using the flow of drawing 9. In step 0901, the spot demand which caused modification first is given to drawing, and it is temporarily set to X. The spot demand leading to modification produces other spot demands and interference, as a result of the time of day of arrival or a start being changed. In the example [ drawing 5 ] of operation turbulence, a spot demand "AA10-AA11" of AA is the cause of modification. Next, in spot 0902, other interference moves the spot demand X to fewest spots. It means that there are few spot demands which overlap that there is least interference. If there is an empty spot which can arrange X without lapping with other spot demands at all, it will serve as fewest spots of interference.

[0036] In the case of the example of drawing 5, although the candidates of a migration place are

spot \*\*, \*\*, and \*\*, wherever it may move X, interference is produced with one spot demand, respectively. However, in order to move the spot demand which produced interference to other spot demands by subsequent processings, an operation settled or the spot which produces the spot demand which cannot move, and interference since it is under operation is excepted from a candidate.

[0037] If X is moved to spot \*\* in the case of the example of drawing 5, since it is under parking now and a spot demand and interference of BB company while doing a ground activity are caused (it is known since the mask is applied to the middle), spot \*\* will be excepted from a migration place. In addition, when there are size of the aircraft which can be parked at an apron, a class of facilities, and conditions of an usable time zone, the number of the candidates of a migration place is narrowed down based on those conditions. In the example of drawing 5, supposing there are no conditions of candidate narrowing-down \*\*\*\*\* a candidate will become spot \*\* or \*\*. Any one of the candidates of these is chosen, and X is moved. Next, in step 0903, as a result of moving X, it is confirmed whether interference arose or not. When there is no interference, since the modification proposal which can be carried out was obtained, processing is ended. When interference arises, it progresses to step 0904, all spot demands of those other than a modification cause that have produced interference in the plan are collected, and it is considered as Set S, the spot demand which produced interference when X was moved to spot \*\* in the example of drawing 5 -- a spot demand "CC10-CC11" of CC company -- it is only one and the set of the single element which makes this an element is set to S. Next, in step 0905, an element is set into one drawing from Set S, and it is temporarily set to Y. At step 0907, the as previously carried out to X, other interference moves Y to fewest spots. At step 0907, the spot demand Y which moved is excepted from Set S. At step 0908, it inspects whether S is empty class, and if it is not empty class, it will return to step 0905 again. If S is empty class, it will progress to step 0909, and it is confirmed whether a new interference arose by migration of Y. When a new interference arises, the dissolution of return and interference is again continued to step 0904. However, in creating Set S anew in step 0904, it excepts all spot demands (the modification cause X is included) that moved from the candidate for creation. Since the modification proposal which can be carried out was obtained when there was no interference, processing is ended.

[0038] In this modification proposal creation processing, the modification proposal which can be carried out by moving the spot demand which interference produced to another spot so that a new interference may not arise as much as possible is created. Therefore, thereby, there are as much as possible few amounts of modification, namely, the number of spot demands which moves can create the fewest possible modification proposals. In addition, since two or more migration places of a spot demand generally exist at step 0902 or step 0905, two or more modification proposals by replacing how choosing the migration place with, and carrying out multiple-times activation of the above-mentioned processing are created. Especially a convention is defined neither about how to choose a migration place nor the number of a modification proposal to create. Moreover, it does not limit to the above-mentioned processing, and meta-heuristics, such as the mathematical technique, such as linear programming and a network-planning method, SHIMYURE Ted annealing, and a genetic algorithm, etc. may apply other scheduling technique, and the modification proposal creation processing itself may build the modification proposal creation processing with possible few amounts of modification.

[0039] Explanation of return adjustment processing is continued to drawing 9. At step 0802, the claim point update information 0105 is computed through the claim point update information calculation section 0116 of drawing 1 based on the modification proposal obtained by previous modification proposal creation processing. The claim point update information calculation section 0116 is a part which manages the are recording and updating of the claim point 0106, computes the claim point update information about the target modification proposal using the current claim point, and returns a result to a controller. The example of the claim point is shown in drawing 10. The claim point is a numeric value given to each airline which is the demand origin of a spot demand.

[0040] In CC company, in the example of drawing 10, BB company has [ AA ] the 39-point claim

point 46 point 58 point. In addition, the notation in drawing "AL" means an airline (Air Line). The claim points are the frequency where set in the past modification proposal creation like the adjustment fault of the frequency which (1) airline caused planned modification, the contents and the frequency which covered the effect of (2) planned modification (migration of a spot demand), its contents, and (3) modification proposals, and the claim was accepted, and the numeric value which fluctuate based on the contents, and it is the barometer which plans the degree of the fairness between airlines intuitively. For example, the point of the airline which caused a lifting and planned creation in many operation turbulence, activity delay, etc. in the past in many cases is relatively low, and the airline which moved the spot demand of its company to other spots in many cases for the operation turbulence of the other company etc. has the conversely expensive point. Moreover, the point of the airline which did not accept the modification proposal created in the spot administration becomes low. When the difference of the claim point of each company is small, it means that each company has received fair treatment in creation of a modification proposal. Conversely, if the difference of the claim point is large, it means that unfairness has arisen. In other words, as for the high airline, the claim point has covered disadvantageous profit relatively, and the claim point means conversely that the low airline has received advantageous treatment as compared with the other company.

[0041] The example of point update information is shown in drawing 11. Point update information consists of standard deviation of change of the point airline which moves spot in modification proposal modification before, and after modification, and the whole claim point after modification. Drawing 1111 expresses the result of having evaluated the modification proposal shown in drawing 6, based on the claim point of drawing 10. By carrying out this proposal shows that the points of AA which is a cause airline which caused modification decrease in number, and the claim point of CC shrine which moves a spot for the operation turbulence by AA increases conversely. Since the remaining airline BB companies do not have fluctuation of the point, this reduces the difference of the claim point of each company clearly as compared with modification before. Thus, the claim points of the airline which became the cause which causes modification in claim point update information calculation processing decrease in number, after computing the point after modification so that the claim point of the airline which receives effect by modification may increase conversely, the standard deviation of the whole claim point is calculated and a result is returned to a controller.

[0042] The outline of claim point update information calculation processing is explained using the processing flow shown in drawing 12. First, at step 1201, all spot demands included in a plan are collected, and it is considered as Set S. At step 1202, a spot demand is given to one drawing from S, and it is temporarily set to X. At step 1203, the spot assigned to X in the current plan is acquired, and it is temporarily set to p1. At step 1204, the spot assigned to X in the modification proposal is acquired, and it is temporarily set to p2. At step 1205, it is confirmed whether p1 and p2 are equal. When p1 and p2 are equal, since modification of the point is unnecessary, it deletes X from Set S and progresses to step 1212. When p1 differs from p2, it progresses to step 1206, and the airline of the demand origin of X is taken out, and it is temporarily set to A.

[0043] At step 1207, it investigates whether A is already registered into update information. If A is registered, it will go to step 1209 directly. In not registering, it progresses to step 1209, after registering A into update information in step 1208. In the case of registration, the point before changing into the initial value of the point after modification is set up. At step 1209, it investigates whether X is a spot demand of the cause of modification, and if it is the cause of modification, the point after updating of A is added in step 1210. Also when it progresses to which of step 1210 and step 1211, after processing progresses to step 1212 and deletes X from Set S. It progresses to step 1213 after that, and investigates whether Set S is empty class. If it is not empty class, progress processing will be again repeated to step 1202. In the case of empty class, it progresses to step 1214, it calculates the standard deviation of the claim point after modification, and ends processing.

[0044] Although especially the concrete numeric value of an increment and reduction of the point in step 1210 and step 1211 is not specified, the regular point is deducted from a

modification cause airline, and you may make it distribute the point to the airline which covered effect equally. Moreover, the value to deduct may define the number of the airlines which affected it instead of a fixed value etc. in proportion to a certain scale which measures the magnitude of effect. Moreover, distribution of the point may be proportioned in the magnitude of the effect which it was not equal and was covered. It is defined as the magnitude of effect having so large that it being changed into the spot left distantly based on the physical distance of the original spot and the spot after modification effect etc.

[0045] Drawing 13 is the result of computing claim point update information to the modification proposal of drawing 6 and drawing 7 to the operation turbulence of drawing 5 using the claim point of drawing 10. Here, we deducted ten points from the cause airline, and decided to distribute the point to the influenced airline equally.

[0046] It is \*\*\*\*\* or \*\* by which fairness is improved from drawing 13 whichever both standard deviation has become small as for the proposal 1 and the proposal 2 and they choose a modification proposal compared with modification before. Especially, the standard deviation of a proposal 1 is sharply small compared with 1.5 and modification before, and the extensive improvement of fairness can be expected rather than a proposal 2.

[0047] Explanation of return and adjustment processing is continued to drawing 8. After computing point update information to a modification proposal at step 0802, one modification proposal shown to an airline in step 0803 is chosen. The proposal chosen here chooses the thing which has the smallest standard deviation of the claim point included in update information, i.e., the proposal that the improvement of fairness is the biggest, (however, a thing [ finishing / presentation ] is removed to an airline). Next, in step 0804, the modification proposal chosen as the terminal unit (0205 of drawing 2) of a related airline and its claim point update information are transmitted through a network. In the terminal unit side of an airline, the received information is displayed on a person in charge, and it looks for the decision. In response, a person in charge chooses either "acceptance" or "refusal", and transmits to spot management equipment through a network. The requiring agency reply data 0103 of drawing 1 total the reply from the airline side obtained by the inquiry. In a spot management equipment side, branching is judged at step 0805 based on requiring agency reply data. When the consent from all related airlines is obtained, the modification proposal which progressed to step 0807 and was chosen is decided with a formal proposal, and this is notified to its related posts, such as an airline and oil supply service. From all airlines, when consent is not obtained, it progresses to step 0806. At step 0806, the count of accumulation of the refusal which can be set like the identifier and adjustment fault of marking, i.e., an applicable airline, to the airline which notified the reply of "refusal" is stored in the exclusive field of storage. The purport to which the claim points decrease in number by refusal of a modification proposal through a network with it is notified to the terminal unit of an applicable airline. And return and the modification proposal which the airline was shown previously are again set as step 0803 a presentation settled, and a modification proposal is chosen again.

[0048] After deciding a modification proposal in step 0807, in step 0808, the claim point is updated through the renewal section 0117 of the claim point of drawing 1, and the whole adjustment processing is ended.

[0049] The contents of the claim point update process are explained using the processing flow Fig. of drawing 14. First, from the claim point update information of the modification proposal decided in step 1401, all the airlines included there are assembled and it is considered as Set S. Next, in step 1402, an airline is set into one drawing from S, and it is temporarily set to X. At step 1403, it changes into the value after updating the claim point of Airline X according to update information. At step 1404, X is removed from S and S judges whether it is empty class in step 1405. In empty class, when there is nothing, renewal of the return point is again continued to step 1402. When S is empty class, it progresses to step 1406. At step 1406, subtraction processing of the claim point is performed to all the airlines that did marking in the process of adjustment processing. Although especially the detail of subtraction processing is not specified, a fixed value may be subtracted uniformly and you may make it subtract a big numeric value in proportion to the count of refusal. The whole point update process is ended now. As mentioned

above, an adjustment fault seasons the claim point update information of the settled modification proposal with (marking to an airline), and the claim point is updated.

[0050] Next, the 2nd example of this invention is explained using drawing 17 from drawing 15 R.

5. The 2nd operation gestalt is equipped with the means for which the person in charge of the airline which has the hope of correction to a modification proposal, and the person in charge of spot management negotiate directly with an image and voice in the process in which a modification proposal is adjusted. The functional configuration of the 2nd operation gestalt extends the functional configuration of the 1st operation gestalt, as shown in drawing 15. In drawing 15, a controller 0114 is the processing section similar to the thing of the same sign of drawing 1. An image and voice data 1501 accumulate speech information in the image list incorporated by the photography section 1511, and transmits it to an airline terminal unit (0205 of drawing 2) through a network. In addition, it has all the configuration sections with which the 1st operation gestalt shown in drawing 1 is equipped.

[0051] However, in addition to the information about the monitor from the employment Monitoring Department 0111 and a controller 0114, and adjustment, the output section 0112 also transmits the image and voice data from the photography section 1511 to a person in charge through a controller 0114 like the 1st operation gestalt. Moreover, although the contents of processing of a controller 0114 differ from the 1st operation gestalt, about this, the detail is explained later. Other parts are the same as that of the 1st operation gestalt.

[0052] As shown in drawing 16, the configuration of the 2nd operation gestalt extends the configuration of the 1st operation gestalt, and connects a camera 1601, a microphone 1602, and a loudspeaker 1603 to the same computer as the computer 0201 of drawing 2. Although the camera 1601 assumes what can photo an animation, it may photo a static image.

[0053] Moreover, the airline terminal unit 0205 of drawing 2 was equipped with input devices, such as graphic display, a mouse, and a keyboard, upwards, is equipped with a camera, a microphone, and a loudspeaker, and assumes the computer which can transmit and receive an image and voice data and by which network connection was carried out, a liquid crystal notice panel, etc. The specification of other devices is the same as that of the 1st operation gestalt of this invention.

[0054] Hereafter, the contents of processing of the controller 0114 in the 2nd example of this invention are explained using the processing flow Fig. of drawing 17.

[0055] First, the same processing as the adjustment processing of the 1st operation gestalt which shows step 0805 in drawing 8 from initiation is followed. At step 0805, it confirms whether have agreed with the modification proposal which all related airlines chose, when all consent is obtained, it progresses to step 0807 of drawing 8, and the rest follows the same processing as the flow of drawing 8. The person in charge of the airline which all consent progressed to step 1701 when not obtained, and has not agreed, and the person in charge of spot management perform direct negotiation, exchanging an image and speech information through a network using a camera microphone, respectively. In correcting a modification proposal as a result of negotiation with an airline as a result of direct negotiation, in step 1702, it corrects a modification proposal manually using input units, such as a mouse and a keyboard. If there is no need for correction, nothing will be performed here. Next, in step 0802, the claim point update information of the corrected modification proposal is computed. This is the same as that of processing of drawing 12 explained previously. At step 1703, a negotiation partner's airline is again notified of the corrected modification proposal and its claim point update information. At step 1704, branching decision of processing is performed based on the answerback from a negotiation partner. When a negotiation partner's airline does not agree with a modification proposal, it returns to direct negotiation of step 1701 again. When the negotiation partner has agreed, it progresses to step 1705 and marking of a negotiation partner's airline is carried out only within the case where a manual correction arises. However, in a predetermined case, for example, when what has correction unavoidable at a certain reason, and a spot management person in charge accept, you may enable it to cancel marking manually here. The notice of re-of return and the corrected modification proposal is again performed to step 0804 after that.

[0056] Next, the 3rd example of this invention is explained using drawing 18 R 8 and drawing

19. The 3rd operation gestalt is equipped with a means to draw up the prior plan of spot allocation used as the base of a spot employment monitor in consideration of the claim point of each aeronautical-navigation company. Rather than the airline which there was little claim point, i.e., received advantageous treatment in the process of the past planned modification and its adjustment correctly, there is much claim point, namely, the airlines which covered disadvantageous profit draw up a plan to have been treated more favorably.

[0057] The functional configuration of the 3rd operation gestalt extends the functional configuration of the 1st operation gestalt, as shown in drawing 18. In drawing 18, the claim point 0106, the allotment plan data 0101, and the employment Monitoring Department 0111 are the same processing sections as the thing of the same sign of drawing 1. In drawing up a prior plan, basic data 1801 stores the spot use hope of a spot demand of various required data and each aeronautical-navigation company, the service condition of a spot, and an airline at least, and it is used for it as input data of the prior planned creation processing in the planned creation section 1811. In addition, it has all the configuration sections with which the 1st operation gestalt shown in drawing 1 R 1 is equipped. The configuration of the 3rd operation gestalt has the same function as the configuration of the 1st operation gestalt.

[0058] Hereafter, the contents of the prior planned creation processing in the 3rd example of this invention are explained using the processing flow Fig. of drawing 19.

[0059] First, in step 1901, all the airlines for a plan are assembled and it is considered as Set S. At step 1902, each airline in Set S is sorted according to the claim point which it has now. At step 1903, the head element (namely, element of max [point]) of a sort result is set into drawing, and it is temporarily set to X. At step 1904, a requiring agency extracts altogether the spot demand which is X from input data, and considers it as Set H. Next, in step 1905, a spot demand is given to drawing from Set H, and it is temporarily set to Y at one arbitration. Out of the spot which fills with step 1906 the spot service condition stored in the basic data 1801, such as classification of the size of a spot, a location, an usable time zone, and facilities, to the spot as demand Y and which can be assigned, while satisfying the spot use hope of Airline X as much as possible, generating of interference chooses the one fewest possible spot, and assigns the spot to the spot demand Y.

[0060] At step 1907, it investigates whether interference occurs by allocation. When there is no interference, it progresses to step 1909 directly. When interference arises, before progressing to step 1909, in step 1908, interference is avoided by changing the plan in the middle of creation partially. This processing is realized by applying modification proposal creation processing of drawing 9 which explained the allotment plan Y and for modification for the spot demand of the cause of modification previously as a plan in the middle of the present creation. Thereby, interference can be avoided, without changing the present plan as much as possible. the assigned spot demand Y in step 1909 — Set H — it removes clutteringly.

[0061] At step 1910, Set H investigates whether it is empty class. When it is not empty class, since the non-assigned spot demand remains, it returns to step 1905 again and processing is continued. Since all spot demands of Airline's X demand origin are allocation settled, in the case of empty class, X is removed from Set S, and it progresses to step 1912. At step 1912, Set S investigates whether it is empty class. Since the unsettled airline remains when it is not empty class, it returns to step 1903 again and processing is continued. In the case of empty class, since the predetermined airline was processed and the allotment plan was obtained, the whole processing is ended.

[0062] Since priority is given from the high airline of the claim point and a spot is assigned by the above-mentioned processing, a prior plan advantageous to the airline which covered disadvantageous profit in the process of the past planned modification and its adjustment can be drawn up. In addition, the procedure of prior planned creation processing is not limited to this, and as long as planned creation equivalent to this is possible, meta-heuristics, such as the mathematical technique, such as linear programming and a network-planning method, SHIMYURE Ted annealing, and a genetic algorithm, etc. may be built with the application of other scheduling technique.

[0063] Next, the 4th example of this invention is explained using drawing 20 R 0 and drawing



21.

[0064] The 3rd operation gestalt is equipped with a means to compute accounting to having used the spot, i.e., the parking tariff of a spot, in consideration of the claim point of each aeronautical-navigation company. It computes a parking tariff by there being much claim point, namely, discounting the parking tariff of the airline which covered disadvantageous profit rather than the airline which there was little claim point, i.e., received advantageous treatment in the process of the past planned modification and its adjustment correctly.

[0065] The functional configuration of the 4th operation gestalt extends the functional configuration of the 1st operation gestalt, as shown in drawing 20. In drawing 20, the claim point 0106 and the employment Monitoring Department 0111 are the same processing sections as the thing of the same sign of drawing 1. An investment return 2001 accumulates the spot operating experience of employment that day transmitted from the employment Monitoring Department. In addition, the data format of an investment return is the same as allotment plan data (0101 of drawing 1). After considering the claim point based on the spot operating experience of each aeronautical-navigation company, the resource dues calculation section 2011 computes a resource, i.e., the toll of a spot, and stores the result in accounting information 2002. Accounting information is information required in order to publish the bill of spot dues to each aeronautical-navigation company, and contains the spot time for every airline, the toll, the rate of discount/premium, etc. In addition, it has all the configuration sections with which the 1st operation gestalt shown in drawing 1 is equipped. The configuration of the 4th operation gestalt has the same function as the configuration of the 1st operation gestalt.

[0066] Hereafter, the contents of the resource toll calculation processing in the 4th example of this invention are explained using the processing flow Fig. of drawing 21.

[0067] First, in step 2101, all the airlines for accounting are assembled and it is considered as Set S. At step 2102, an airline is set into drawing from Set S, and it is temporarily set to X at one arbitration. At step 2103, the total spot time of Airline X is computed with reference to an investment return, and this is temporarily set to T. At step 2104, the charge of basic parking of a spot is computed based on the total spot time. Generally, the charge of spot parking is decided according to the die length of parking time amount. The class of aircraft which used the spot depending on the case etc. may be taken into consideration. Therefore, the detail of this processing follows the Ruhr of the airport for application.

[0068] next -- step 2105 -- the claim point of Airline X -- acquiring -- it -- using -- step 2106 -- setting -- application -- rate R (%) is computed. application -- a rate -- R is set to either of a discount rate, i.e., less than 100% of value, and the rate of a premium, i.e., 100% or more of value, according to the claim point. although the calculation approach does not carry out especially a convention -- the claim point -- relative -- application of a high airline -- a rate -- relative -- application of a low airline -- it is contingent [ on becoming surely smaller than a rate ]. for example, the approach described below -- application -- a rate is computed. (1) Compute the average of the claim point of an airline. (2) When the point of the airline for calculation is lower than the average, consider as a premium, when conversely higher than the average, consider as discount, and compute a rate in proportion to the magnitude of the distance (rate of deviation) from the average.

[0069] application -- after computing rate R (%), in step 2107, the parking tariff of Airline X is calculated as x (minimum charge) (application rate), and it accumulates in accounting information. At step 2108, X is removed from Set S and it investigates whether the element remains in Set S at step 2109. When the element still remains, return tariff calculation is continued to step 2102. Processing is ended when tariff calculation is performed about a predetermined element. According to the gestalt of the 1st - the 4th operation mentioned above, the point is given to each demand origin as a barometer which plans the degree of the fairness of job demand origin. Under convention that the job demand origin which other resource modification whose job demand origin leading to modification reduces the point produced increases the point Since the point gap chose preferentially the fair modification proposal by which it is shortened most, the claim frequency from job demand origin can be reduced, and the load in planned modification of a person in charge can be reduced.

[0070] Moreover, since the modification proposal with few amounts of modification from the present plan was created preferentially, similarly the claim frequency from job demand origin can be reduced, and the load in planned modification of a person in charge can be reduced.

[0071] Moreover, since it was made to perform creation and adjustment of a modification proposal semi-automatically, a person's in charge load can be reduced.

[0072] Moreover, adjustment between persons in charge can be more flexibly performed by having established the direct negotiation means using an image and speech information.

[0073] Moreover, it has a means to draw up the prior plan of resource allocation, and since it decided to draw up the allotment plan to which the point gave priority to job demand origin with much point over little job demand origin, fairer resource allocation management can be performed.

[0074] Moreover, since it decided to compute a resource toll by having a means to compute the toll of a resource and the point discounting the tariff of premium and job demand origin with much point for the tariff of little job demand origin, same more fair resource allocation management can be performed.

[0075]

[Effect of the Invention] according to this invention -- \*\*\*\* -- it becomes possible to perform allocation and modification of a resource efficiently.

[Translation done.]

\* NOTICES \*

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the whole spot managerial system block diagram in this invention which is the gestalt of the 1st operation.  
[Drawing 2] It is drawing showing the configuration in this invention which realizes the gestalt of the 1st operation.  
[Drawing 3] It is drawing showing the DS of the allotment plan data 0101 in drawing 1.  
[Drawing 4] It is drawing having shown the spot allocation situation in the chart format.  
[Drawing 5] It is drawing having shown the example of the operation turbulence generated during an employment monitor in the chart format.  
[Drawing 6] It is drawing showing an example of the planned modification proposal to the operation turbulence of drawing 5 in a chart format.  
[Drawing 7] It is drawing showing another example of the planned modification proposal to the operation turbulence of drawing 5 in a chart format.  
[Drawing 8] It is the detail block diagram of the controller 0114 in drawing 1.  
[Drawing 9] It is drawing showing the processing flow of the modification proposal creation processing 0801 in drawing 8.  
[Drawing 10] It is drawing showing the DS of the claim point 0103 in drawing 1.  
[Drawing 11] It is drawing showing the DS of the claim point update information 0104 in drawing 1.  
[Drawing 12] It is drawing showing the processing flow of the claim point update information calculation processing 0802 in drawing 8.  
[Drawing 13] It is drawing showing the example of application of claim point update information calculation processing.  
[Drawing 14] It is drawing showing the processing flow of the claim point update process 0808 in drawing 8.  
[Drawing 15] It is drawing in this invention showing the 2nd configuration of the spot managerial system of the gestalt of operation.  
[Drawing 16] It is drawing showing the configuration in this invention which realizes the gestalt of the 2nd operation.  
[Drawing 17] It is drawing in this invention showing the processing flow of adjustment processing of the gestalt of the 2nd operation. <BR> [Drawing 18] It is drawing in this invention showing the 3rd configuration of the spot managerial system of the gestalt of operation.  
[Drawing 19] It is drawing showing the processing flow of the prior planned creation section 1811 of drawing 18.  
[Drawing 20] It is drawing about the configuration of the spot managerial system of the gestalt of the 4th operation in this invention.  
[Drawing 21] It is drawing showing the processing flow of the resource dues calculation section 2002 of drawing 20.  
[Description of Notations]  
0101: Allotment plan data, 0102:that day employment information, 0103:demand former reply data, a 0104:allotment plan modification proposal, 0105:claim point update information, the

0106:claim point, the 0111:employment Monitoring Department, the 0112:output section, the 0113:input section, a 0114:controller, 0115:modification proposal creation section, the 0116:claim point update information calculation section, 0117 : renewal section of the claim point

[Translation done.]



(3)

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納得のいくような明確なポリシーに沿った合理的な変更案の作成が困難であった。

(2) 計画変更に公平性の配慮がない。例えば、変更案作成の際に、A社とB社のいずれかをスポット変更の対象に選ぶ状況が生じたとき、A社は運航乱れや作業の遅延が多く、計画変更の原因となることが多い。一方、B社は運航・作業共に正確で計画変更の原因になることがほとんどないとする。この場合、他の条件が全く同一ならばスポット変更の対象としてA社を選択することが公平な判断と言えるが、(1)と同様に場当たり的な手作業では、このように配慮を著しに期待することができなかつた。また、調整過程においても公平性の意識が欠如していることから、結果として特定の航空会社のクレームばかりが受け入れられ、他の航空会社が不利を被るという状況が起り得た。

(3) 担当者間の適切なコミュニケーション手段がない。電話やFAXだけでは、変更内容や担当者の意図を正確に伝える能力に限界があるため、複雑な調整を効率良くおこなうには不便であった。

【0010】以上、航空会社のスポット管理業務を例として問題点を説明したが、これはスポット管理業務だけでなく、列車の座席予約、生産現場の要配慮、配送車両の割当て、等、交通・生産・物流等の分野において、複数のジョブに跨るリソースを配分し、その利用を監視する業務において、リソースの統合をジョブ要求元の利害関係を調整しつつ解消する際に広く共通する問題である。

【0011】本発明の目的は、リソース割当て管理に関わる上記の問題点を解決し、担当者が小さな負荷で効率的に割当て管理の調整をおこなうことが可能な、計算機を利用したリソース割当て管理システムを提供することにある。

【0012】

【問題点を解決するための手段】上記問題を解決するためには、本発明は、ジョブ要求元にポイントを与え、リソース割当て管理を変更する際、リソース割当て計画と当日運用情報に基づいて複数の割当て計画変更案を作成し、変更案実施前後のジョブ要求元のポイント更新情報を算出し、ポイント更新情報に基づき最適な割当て計画変更案を選択し、最適な割当て計画変更案とポイント更新情報とをジョブ要求元に通知し、変更案の選択と通知を再びおこなうか、または変更案を確定しポイントを更新する。

【0013】ポイント更新情報の算出においては、(1)計画変更の原因となったジョブ要求元は現在のポイントから減算し、(2)それ以外でリソース変更があったジョブ要求元は現在のポイントに加算、して計画変更後のポイントを決する。

【0014】変更案の選択においては、変更案に対するポイント更新情報を用いて、計画変更後のポイント増減

が最も小さい割当て計画変更案を優先的に選択する。

【0015】ポイントの更新においては、ポイント更新情報に依り、(1)計画変更の原因となったジョブ要求元は現在のポイントから減算し、(2)それ以外でリソース変更があったジョブ要求元は現在のポイントに加算する。さらに、変更案確定までに非承認回答したことがあるジョブ要求元に対しては、現在のポイントから減算してポイントを更新する。また、現在計画からの変更量が少ない変更案ほど優先的に作成する。

【0016】また、映像・音声の記録手段を備え、映像及び音声情報を用いたジョブ要求元の担当者と直接交渉が可能とする。

【0017】また、リソース割当ての事件計画を作成する手段を備え、ポイントが少ないジョブ要求元よりも、ポイントが多いジョブ要求元の料金を割増し、ポイントが多いジョブ要求元の料金を割引いてリソース使用料金を算出する。

【0018】また、リソースの使用料金を算出する手段を備え、ジョブ要求元のポイントに応じて、ポイントが少ないジョブ要求元の料金を割増し、ポイントが多いジョブ要求元の料金を割引いてリソース使用料金を算出する。

【0019】

【発明の実施の形態】以下では、航空分野における空港のスポット管理業務を適用対象として、本発明の実施の形態であるスポット管理システムについて図1から図21を用いて詳細に述べる。

【0020】まず、第1の実施の形態について図1から図14を用いて説明する。

【0021】図1に、本発明の実施例の構成図を示す。図1において、運用監視部0111は、スポット割当て計画データ0101に基づき、計画実施日当日の航空機の通航及びスポット利用状況を基き当日運用情報0102に算出される航空機利用状況を基き当日運用監視部が異常を検知し、計画変更の必要が生じた場合には、調整部0114を起動する。調整部0114は、変更案作成部0115を介して得られる割当て計画変更案0104と、クレームポイント更新情報0105、16を介して得られるクレームポイント更新情報0105、16を基き、航空会社(ジョブ要求元)側の端末装置から得られる要求元回答データ0103に基づいて変更案の調整をおこなう。クレームポイント更新情報0117は、確定した変更案のクレームポイント更新情報に基づきクレームポイントを更新する。運用監視部0111と調整部0114からは、監視及び調整に関する情報が出力部0112を介して担当者へ通知伝えらる。逆に担当者からは、入力部0113を介して監視部0114へ伝えらる。

【0022】図2に、本実施の形態を実現する機器構成を示す。本実施の形態を実現するためには、計算機0201に出力装置0203、記憶装置0202、入力装置0204、を接続したものを、航空会社端末装置0205、運用情報提供装置

0206とネットワーク機器を介して接続したものをを用いばよい。なお、計算機0201は、出力装置0203等と一体の物であっても構わない。

【0023】記憶装置0202は、磁気記憶装置に限らず、光ディスクや半導体メモリであってもよい。要はプログラムの実行やデータを格納するために充分な容量を備えている限りよい。

【0024】入力装置0203は、マウスを想定しているが、キーボードや他の入力装置を用いてもよいし、それらを組み合わせて用いても、またどれか一つでもよい。入力装置は機能の有し以上の操作に応じて情報を受け付けるラックディスプレイを想定しているが、他の出力装置を用いてもよいし、それらを組み合わせて用いても、またどれか一つでもよい。つまり、計算機0201が有する情報を出力可能なものであればよい。

【0025】運用情報提供装置は、DITAX(国内航空交通情報処理中継システム)、各航空会社のFIS(フライト情報システム)等、当日の航空機の通航状況とスポット使用状況を取得可能なものを想定している。

【0026】航空会社端末装置0205は、グラフィックディスプレイとマウスやキーボード等の入力装置を少なくし、またネットワーククライアント用の計算機を想定しているが、スポット管理者側から送られる変更案とポイント更新情報を受領して航空会社側の担当者に提示し、変更案に対する航空会社側の応答を送信可能なものなら、その他の機器でも構わない。例えば、応答用のスイッチを備えたネットワーク接続可能な液晶パネルを用いてもよい。本発明を実施するために製作した専用装置であっても、上述のような周辺機器の機能が充足されていればよい。

【0027】本実施の形態では、記憶装置0202には、割当て計画データ0101、割当て計画変更案0104、クレームポイント更新情報0105、クレームポイント0106が格納されている。さらに、記憶装置0202には、各処理部で実行するプログラムが格納されている。ここで記憶装置0202は物理的に一つの記憶装置であっても複数の記憶装置であってもよい。また、当日運用情報0102は運用情報提供装置0206、要求元回答データ0103は航空会社端末装置0205から、ネットワークを介してそれぞれ送られる。

【0028】図3に、スポット割当て計画データのデータ構造を示す。表の各行は、スポット要求とそれに対するスポット割当てを表す。その項目は左から順に、「要求の通し番号」、「要求元の航空会社」、「到着便名」と「到着予定時刻」、「出発便名」と「出発予定時刻」として「割当てスポット」である。例えば図の一行目は、航空会社AAが自社の航空機を10時30分から11時55分迄スポット0に駐機することを意味する。このように空港を利用する全ての航空機に対して駐機スポットの割当てが割当て計画作成業務において事前におこなわれ、割当

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割当て計画データ0101としてまとめられる。

【0029】運用監視部0111は、割当て計画データ0101に基づき、DITAXやFISといった運用情報提供装置からネットワークを通じて送信される当日運用情報0102に異常がないかどうか監視し、出力部0112を介してスポットの利用状況を担当者に逐次伝達する。当日運用情報0102は、(1)航空機のスポット使用開始・終了情報、(2)航空機の運航予定の変更情報、(3)駐機中の作業予定の変更情報、を少なくとも含む。図4は、スポット利用状況の伝達形式の一例であるチャート形式である。図の横軸は1日1時間の時間帯、縦軸は空港内のスポットを表す。スクリーンが備えられた部分は実施済の部分、マスクのない部分は計画部分を表す。チャート内の白バーはスポット要求を意味し、例えばバー0401は、航空会社Bの航空機が12時30分から14時までスポット0を使用すると読み取ることができ。また、各バーの内部に描かれた記号は、左側に到着便名、右側に出発便名である。マスク部分とマスクのない部分の境界部分が現在時刻を意味し、時間の推移と共にチャート上を右方向へ移動していく。

【0030】運用監視部0111は、担当者にスポット利用状況を伝達するだけでなく、将来の計画遂行に支障のないかどうかのチェックをおこなう。図5は、航空機の運航が乱れ、計画遂行に支障が生じた状況の一例をチャート形式で示したものである。図の矢印は、天候悪化のため航空会社AAの便に到着遅延が発生し、それに伴い同便機が使用される出発便の発出予定時刻も遅れることになり、スポット0の駐機時間が繰り上げられ、スポット0を意味する。その結果、このままでは同じスポットを使用する予定の陸社のスポット要求と干渉を生じることになる。

【0031】図6は、図5の運航乱れに対する計画変更案の一例である。スポット0に割当てられたB社のスポット要求をスポット0に移動し、変更原因となったA社のスポット要求をスポット0に移動する。これにより干渉の発生を回避できる。また、図7は、図5の運航乱れに対する計画変更案の別の例である。スポット0に割当てられたB社のスポット要求をスポット0に移動し、変更原因となったA社のスポット要求をスポット0に移動する。これにより先と同様に干渉の発生を回避できる。このように計画変更案は一般的に複数存在する。上記の例では、先に示した2つの例以外に変更案はいくつか考えられるが、それらはいずれもより多くのスポットを要求の移動が必要である。図5から明らかにように、先の2つの変更案は、リソース(スポット)割当てを変更するジョブ(スポット要求)の数が最も少ない変更案である。

【0032】計画変更の原因となるイベントは、先に示した運航の乱れ以外にもいくつか考えられる。荷物の搬入作業が予定より遅引くことで出発時刻が遅れ、後続のスポット要求と干渉する、といった駐機中の作業の遅延

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は、その典型的な例である。

【0033】上記のように変更案は一般的に複数考えられるが、従来のスロット管理においては、異種が発生した場合、担当者が様々な条件を考慮して経験に基づき手作業で変更案の作成をおこなっていた。これに対して本発明では、運用監視部011が異種を検出した場合、調整部0114を起動し、調整部0114が変更案を作成した0115を介して変更案を自動的に作成すると共に、航空会社側の端末装置と通信をおこない、変更案の調整を半自動的にこなう。

【0034】以下では、図9の処理フローを用いて本実施例における調整部0114の動作を説明する。まずステップ0801において、図1の変更案作成部0115を介して変更案作成処理をおこない、図1の割当計画変更案0104を得る。割当計画変更案のデータ構造は、図1の割当計画データ0101と同一である。

【0035】この処理の概要を、図9のフローを用いて説明する。まずステップ0901において、変更原因となつたスロット要求を取り出し、それを仮にXとする。変更原因となつたスロット要求とは、到着や出発の時刻が変更になった結果、他のスロット要求と干渉を生じたものである。図5の運航乱れの例においては、A社のスロット要求「A10-A11」が変更原因である。次にスロット0902において、スロット要求Xを他の干渉が最も少ないスロットに移動する。干渉が最も少ないとは、重なり合うスロット要求の数が最も少なくないことを意味する。他のスロット要求と全く重ならないXを配置可能な空きスロットがあるならば、それが干渉の最も少ないスロットとなる。

【0036】図5の例の場合は、移動先の候補はスロット③、④、⑤であるが、Xをどこに移動してもスロット要求1個とそれと干渉を生じる。ただし⑤の処理で、干渉を生じたスロット要求を他のスロット要求に移動するため、実施済、もしくは実施中のため移動が不可能なスロット要求と干渉を生じるスロットは候補から除外する。

【0037】図5の例の場合は、スロット③へXを移動すると、現在駐機中で地上作業・整備中のB社のスロット要求と干渉を起こす（マスクが途中までかかっている）のでそれがわかる。スロット④は移動先から除外する。これに加えて、駐機可能な航空機のサイズ、便の頻度、使用可能時間帯といった条件がある場合には、それらの条件に基づいて移動先の候補の数を絞り込む。図5の例において、候補数込みの他の条件がないとすると、候補はスロット④の④となる。これらの候補のどれか1つを選択してXを移動する。次にステップ0903において、Xを移動した結果、干渉が生じたかどうかをチェックする。干渉がない場合には、実施可能な変更案が得られたので処理を終了する。干渉が生じた場合には、ステップ0904へ進み、計画の中で干渉を生じてい

る、変更原因以外のスロット要求を全て集めてそれを集合Sとする。図5の例においてXをスロット④に移動した場合、干渉を生じたスロット要求はB社のスロット要求「C10-C11」ただ1つであり、これを要素とする単一要素の集合をSとする。次にステップ0905において集合Sから要素を1つ取り出し、それを仮にYとする。ステップ0906では、先にYに対しておこなったように、Yを他との干渉が最も少ないスロットに移動する。ステップ0907では、移動したスロット要求を集合Sから除外する。ステップ0908では、Sが空集合であるかどうかを検査し、空集合でなければ再びステップ0905へ戻る。Sが空集合ならばステップ0909へ進み、Yの移動によって新たな干渉が生じたかどうかを検査する。新たな干渉が生じた場合には再びステップ0904へ戻り、干渉の解消を繰り返す。ただしステップ0904において改めて集合Sを作成する場合には、移動した全てのスロット要求（変更原因Xを含む）を作成対象から除外する。干渉がない場合には実施可能な変更案が得られたので処理を終了する。

【0038】この変更案作成処理では、干渉が生じたスロット要求を、新たな干渉ができるだけ生じないように別のスロットへ移動することで実施可能な変更案の作成をおこなう。したがって、これにより変更量ができるだけ少ない、すなわち移動するスロット要求の数ができるだけ少ない変更案を作成することができ、なお、ステップ0902やステップ0905ではスロット要求の移動先が一般には複数存在するので、その移動先の選り方を変えて上記処理を複数回実行することで複数個の変更案を作成する。移動先の選り方や作成することで変更案の個数については特に規定はしない。また、変更案作成処理自体も上記の処理に限定するものではなく、線形計画法やネットワーク計画法等の数理的手法、シミュレーション・アニメーション法等の数理的手法、メタヒューリスティクス等、他のスケジューリング手法を採用して変更量ができるだけ少ない変更案作成処理を構築して良い。

【0039】図8に、戻り調整処理の説明を続ける。ステップ0802では、先の変更案作成処理で得られた変更案に基づいて、図1のクレームポイント更新情報0105を算出する。16を介してクレームポイント更新情報0105を算出する。クレームポイント更新情報算出部0116は、クレームポイント0106の選択と更新を管理する部分であり、現在のクレームポイントを利用して対象の変更案についてのクレームポイント更新情報を算出し、調整部に結果を送る。図10にクレームポイントの例を示す。クレームポイントは、スロット要求の要求元である各航空会社に対して与えられる数値である。

【0040】図10の例では、A社は5.8ポイント、B社は4.6ポイント、C社は3.9ポイントのクレームポイントを持っている。なお図中の記号「AL」とは航空会社（Air Line）を意味する。クレームポイントとは、過去の変更案作成において、(1)航空会社が計画変更を引き

起こした頻度とその内容、(2)計画変更の影響（スロット要求の移動）を被った頻度とその内容、(3)変更案の調整過程においてクレームが受け入れられた頻度とその内容、に基づいて増減する数値であり、直感的には航空会社間の公平さの度合いを図るパラメータである。例えば、過去において運航乱れや作業遅延等を数多く起こし、計画作成の原因となることが多かった航空会社のポイントは相対的に低く、他社と運航乱れ等のために自社スロット要求を他のスロットへ移動することが多かった航空会社は逆にポイントが高くなる。また、スロット管理部門で作成した変更案を受け入れなかった航空会社のポイントは低くなる。各社のクレームポイントの差が小さい場合は、変更案の作成において各社が公平な扱いを受けていることを意味する。逆にクレームポイントの差が大きければ不公平が生じていることを表す。言い換えれば、クレームポイントが相対的に高い航空会社は不利な扱いを受けており、逆にクレームポイントが他社と比較して低い航空会社は有利な扱いを受けていることを意味する。

【0041】図11にポイント更新情報の例を示す。ポイント更新情報は、変更案においてスロットを移動する航空会社の変更前と変更後のポイントの変化と、変更後のクレームポイント全体の標準偏差から構成される。図11は、図10のクレームポイントに基づいて、図6に示す変更案を評価した結果を表している。この案を実施することにより、変更を引き起こした原因航空会社であるA社のポイントが減少し、A社の運航乱れのためにスロットを移動するC社のクレームポイントが逆に増加することがわかる。残りの航空会社はポイントの変動がないため、これにより変更前と比較して各社のクレームポイントの差は明らかに縮小する。このように、クレームポイント更新情報算出処理では、変更を引き起こす原因となつた航空会社のクレームポイントが減少し、変更によって影響を受ける航空会社のクレームポイントが逆に増加するように変更後のポイントを算出した上で、クレームポイント全体の標準偏差を計算して調整部に結果を送る。

【0042】図12に示す処理フローを用いて、クレームポイント更新情報算出処理の概要を説明する。まずステップ1201では、計画に含まれる全てのスロット要求を集め、それを集合Sとする。ステップ1202ではSからスロット要求を1つ取り出し、それを仮にXとする。ステップ1203では、現在の計画においてXに割当てられたスロットを取得し、それを仮にp1とする。ステップ1204では、変更案においてXに割当てられたスロットを取得し、それを仮にp2とする。ステップ1205では、p1とp2が等しいかどうかをチェックする。p1とp2が等しい場合にはポイントの変更は不要なので、集合からXを削除してステップ1212へ進む。p1とp2が異なる場合にはステップ1206に進み、Xの要求元の航空会社を取り出してそれを仮にAと

する。

【0043】ステップ1207では、Aが更新情報に既に登録されているかどうかを調べる。Aが登録済ならばステップ1209へ進捗方向から、未登録の場合は、ステップ1208においてAを更新情報に登録した後にステップ1209へ進む。登録の際には、変更後ポイントの初期値に変更前のポイントを設定する。ステップ1209では、Xが変更原因のスロット要求であるかどうかを調べ、変更原因であるならばステップ1211において航空会社の更新後ポイントを減算する。Aが変更原因でない場合は、ステップ1210においてAの更新後ポイントを加算する。ステップ1210、ステップ1211のどちらに進んだ場合も、処理後はステップ1212へ進み集合SからXを削除する。その後はステップ1213へ進み、集合Sが空集合であるかどうかを調べる。空集合でなければ再びステップ1202へ進み処理を繰り返す。空集合の場合はステップ1214に進み、変更後のクレームポイントの標準偏差を計算して処理を終了する。

【0044】ステップ1210とステップ1211におけるポイントの増加・減少の具体的な数値は特に規定しないが、変更原因航空会社から規定のポイントを差し引き、影響を被つた航空会社はそのポイントを均等に分配する、ようにしても良い。また、差し引き値は固定値ではなく、影響を与えた航空会社の数等、影響の大きさを測る何らかの尺度に比例して定めても良い。また、ポイントの分配は均等ではなく、蓄つた影響の大きさに比例させても良い。影響の大きさは、例えば、元のスロットと変更後のスロットの物理的距離に基づいて、遠く離れたスロットに変更になる程影響が大きい等と定義する。

【0045】図13は、図10のクレームポイントを用いて、図5の運航乱れに対する図6及び図7の変更案に対してクレームポイント更新情報を算出した結果である。ここで、原因航空会社からは10ポイントを差し引き、影響を受けた航空会社はそのポイントを均等に分配することとした。

【0046】図13より、案1と案2は変更前と比べて標準偏差が共に小さくなっており、どちらの変更案を選択しても公平性が改善されることわかる。特に案1の標準偏差は1.5と変更前に比べて大幅に小さく、案2よりも公平性の大幅な改善を期待できる。

【0047】図8に戻り、調整処理の説明を続ける。ステップ0802で変更案に対して航空会社更新情報を算出した後に、ステップ0803において航空会社に提示する変更案を1つ選択する。ここで選択する案は、更新情報に含まれるクレームポイントの標準偏差が最も小さいもの、すなわち公平性の改善が最も大きな案を選択する（ただし航空会社に対して提示済のものを除く）。次にステップ0804において、ネットワークを介して、関係する航空会社の端末装置（図2の0205）に、選択した変更案とそ

のクレームポイント更新情報を送信する。航空会社の端



あり、航空会社毎のスポット使用時間、使用料金、割引／割増率等を含んでいる。この他、図1に示す第1の實施形態が備える構成部を全て備える。第4の實施形態の機器構成は、第1の實施形態の機器構成と同一の機能を有するものである。

【0066】以下、図21の処理フロー図を用いて、本発明の第4の実施例におけるリソース使用料金算出処理の内容を説明する。

【0067】まずステップ2101において、課金対象の至  
ての航空会社を集め、それら集合Sとする。ステップ210  
2では、集合Sから航空会社を1つ任意に取出し、それを  
仮にXとする。ステップ2103では、運用実績を参照して  
航空会社の総スロット使用時間を算出し、これを仮にT  
とする。ステップ2104では、総スロット使用時間を基に  
航空会社の基本燃料料を算出する。一般的に、スロット  
料はスロットの基本燃料料を算出する。ステップ2105  
では、スロットを使用して航空機の運賃等も考慮する  
ことによって、スロットを使用して航空機の運賃等も考慮する  
ことができる。したがって、この処理の詳細は適用対象の  
空港のルールに依る。

【0068】次にステップ2105では、航空会社Xのクレームポイントを取得し、それを用いてステップ2106において適用利率(R)を算出する。適用利率Rは、クレームポイントに応じて割引率、すなわち100%未満の値が、割引率、すなわち100%以上の値のいずれかに定められ、その算出方法は特に規定はしないが、クレームポイントが相対的に高い航空会社の適用利率が、相対的に低い航空会社と比較して、必ず小さくなることを条件とする。例えば以下に述べる方法で適用利率を算出する。

(1) 航空会社のクレームポイントの平均値を算出する。(2) 算出対象の航空会社のポイントが平均値より低い場合は割増し、逆に平均値より高い場合は割引きとし、料金を平均値からの隔たり（乖離率）の大きさに比例して算出する。

【0069】適用料率(%)を算出した後に、ステップ2107において、航空会社の駐機料金を(基本料金)×(適用料率)として計算し、課金情報に蓄積する。ステップ2108では、集合からXを取り除き、ステップ2109で集合中に要素が残っているかどうかを調べる。要素がまだ残っている場合には、ステップ2102に戻り料金算出を続ける。所定の要素について料金算出をおこなった場合、図10のフローチャートは終了する。

合処理を終了する。上述した第1～第4の実施形態の形態によれば、ジョブ要求元の公平さの適合を図るバロメータとして、変更原因とジョブ要求元との関係により、変更原因によってジョブ要求元にポイントを与え、その他のジョブ要求元からジョブ要求元へポイントを減らす、その他のジョブ要求元からジョブ要求元へポイントを増やす、といったジョブ要求元ごとのポイント増減の仕度を行う。この仕度により、ジョブ要求元ごとのポイント格差が最も縮まるようにした上で、ジョブ要求元からジョブ要求元へポイントの移動を促進することによって、ジョブ要求元の公平性を向上させることができる。また、ジョブ要求元の公平性を向上させることにより、ジョブ要求元の公平性を向上させることにより、ジョブ要求元の公平性を向上させることができる。

【図15】本発明における第2の実施の形態のスポーツ管理システムの構成を示す図である。

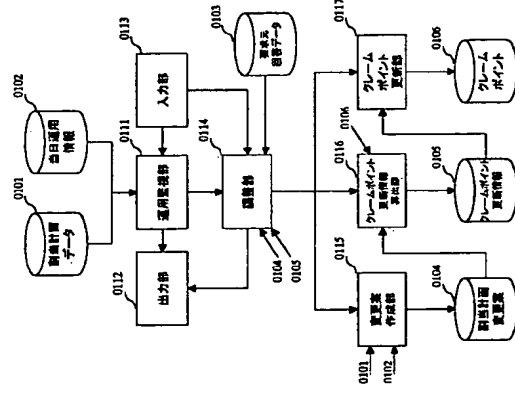
【図16】本発明における第2の実施の形態を実現する機器構成を示す図である。

【図17】本発明における第2の実施の形態の調整処理の処理フローを示す図である。

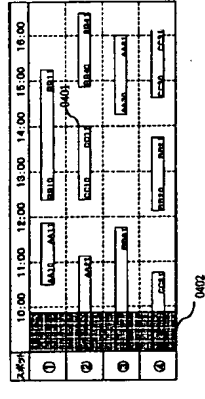
【図18】本発明における第3の実施の形態のスポット管理システムの構成を示す図である。

【図19】図18の事前計画作成部1811の処理フローを示す図である。

【図20】本発明における第4の実施の形態のスポット

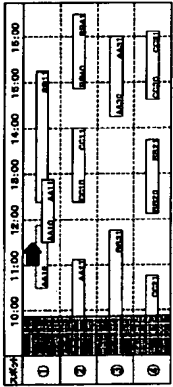


取次 番号	新田会社	新田信		出賃便		スグット
		役名	担当 交際員	役名	出賃 交際員	
1	AA	AA10	10-30	AA11	11-55	①
2	BB	BB10	12-25	BB11	15-10	①
3	CC	CC10	12-30	CC11	14-00	②
4	AA	AA20	8-15	AA21	11-05	②
5	BB	BB20	12-10	BB21	13-45	②



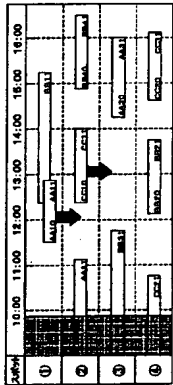
【図5】

図 5



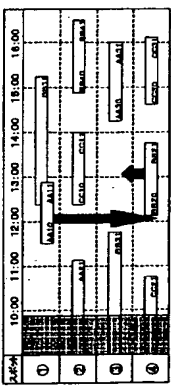
【図6】

図 6



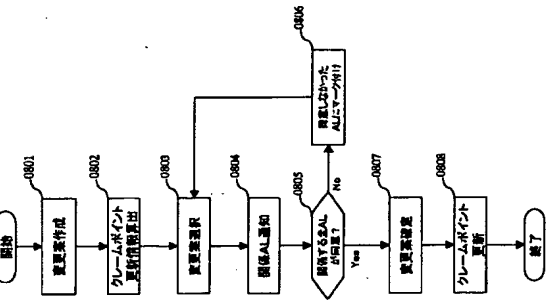
【図7】

図 7



【図8】

図 8



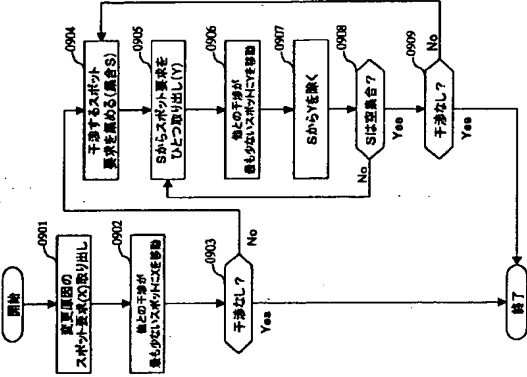
【図10】

図 10

エリア	クレーンポイント
AA	58
BB	46
CC	39

【図9】

図 9



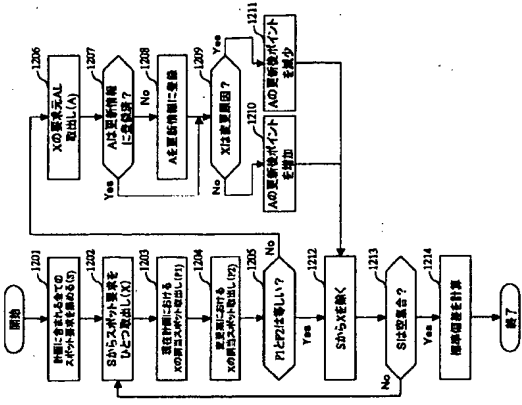
【図11】

図 11

作業前	作業後
AA	58 → 48
CC	39 → 49

ポイント総量 1.5

図 12



【図13】

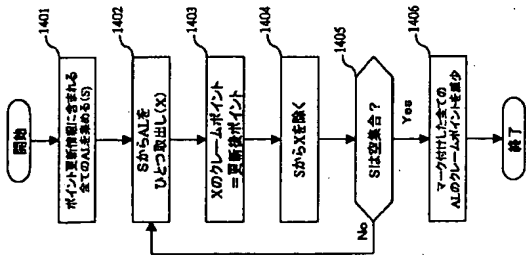
図 13

エリア	作業前	作業後(案1)	作業後(案2)
AA	58	48	48
BB	46	46	56
CC	39	49	39
総量	9.5	1.5	8.5



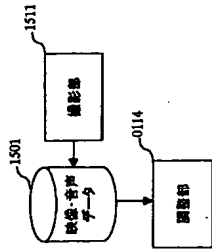
【図14】

図 14



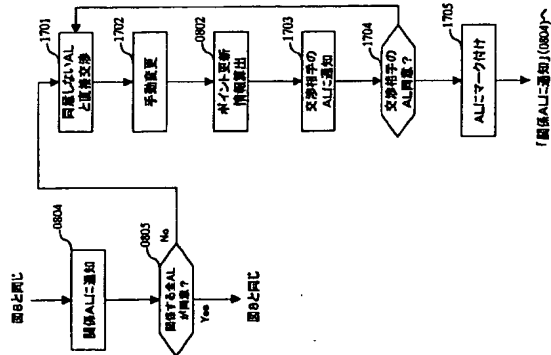
【図15】

図 15



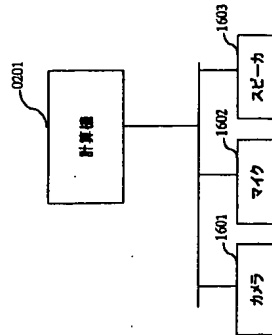
【図17】

図 17



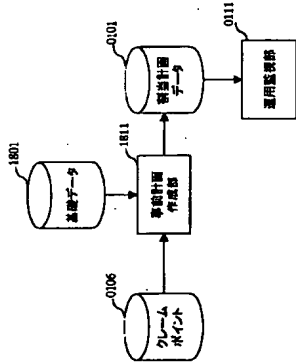
【図16】

図 16



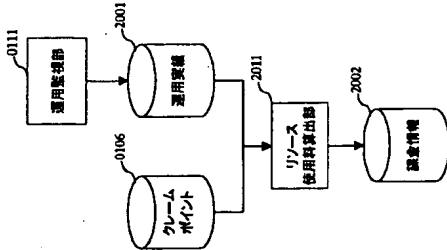
【図18】

図 18



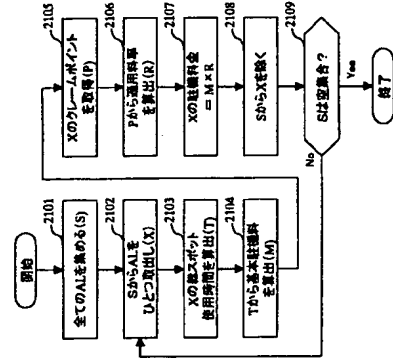
【図20】

図 20



【図21】

図 21



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